Energy

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Thank you. It is such a privilege to be here in Washington at this important conference and I'd like to thank the US Department of Agriculture for inviting CERA to participate. USDA has played a leading and important role on issues of fundamental importance to us all—food, agriculture and natural resources. Since the agricultural industry is a big consumer of energy as well as a producer of energy, we at CERA appreciate the opportunity to share some thoughts on the oil market and the role of biofuels.

On the oil markets research team at CERA, we spend a lot of time reading the tea leaves—and the data—trying to figure out where oil prices might go next. The past several years have been especially challenging, as we've seen a rise in the benchmark light sweet crude oil price from an average of $31 per barrel in 2003 to a peak of $147 per barrel midway through 2008 and now back again now into the $30s—with this last leg of the price swing occurring in just the space of a few short months. I'll start by going over some of the reasons for this unprecedented swing in oil prices. Then I'll switch to the role of biofuels within the energy market and talk about how biofuels might play an even bigger role in the future.

Let's start with a historical look at oil price trends. From 1986 to 2002, the average price for light sweet crude oil was about $21 per barrel. By the first quarter of 2004, the oil price rose to over $35— a price, we should remind ourselves, that many observers at the time considered very high. In retrospect, the reasons for oil's rapid rise seem fairly clear.

From 2003 to 2007, the world economy grew at its fastest pace in a generation. World oil demand jumped as a result. In one year alone—2004—oil demand grew 3 million barrels per day— which is a rate normally only achieved over the course of about three years. So in this sense, as oil prices rose, they acted as a kind of barometer of the world economy. As opposed to the oil crises of the past, this time rising prices were caused by a “demand shock”, and not a “supply shock”.

With demand growing so rapidly, the oil industry’s spare capacity was reduced to the thinnest of margins. At the same time, the strong economic climate and the rush to develop new projects caused costs in the oil industry to rise very rapidly. Rising prices for steel, labor and engineering services caused the cost of producing a barrel of oil to more than double between 2000 and the third quarter of 2008.

There was talk of $200, even $300 oil. What many forgot was that the oil market is cyclical, and is just as prone to boom and bust as it ever was. The foundation of high prices began to crack as early as 2005 when demand in OECD countries started to erode. Motorists began driving less and buying more fuel efficient vehicles. The Toyota Prius outsold the Ford Explorer in 2007, a bell-weather event given that the Explorer was the best selling SUV in the United States for more than a decade.

Now the oil market has been hit by another type of demand shock—a reverse demand shock—the shock of recession. We expect this year that aggregate world GDP will decline—the first time this has happened since the 1930s. This will be the first time since

the early 1980s that world oil demand has seen two consecutive years of declining demand.

In just six short months, the price has plunged more than $100 back to where we started five years ago. Of course this is a boon to consumers, and if low prices are sustained throughout the year as they are likely to be given the weak state of world demand, it is the equivalent to another several hundred billion dollar fiscal stimulus package. On the other hand, because industry costs have risen so much over the past several years, the oil price is now lower than the cost to find, develop and produce oil in many important producing areas. Most new projects in the Canadian oil sands, for example, are now on hold, as boom turns to bust. Looking ahead, one possibility is that if enough new projects around the world get delayed or deferred, future supply may not be adequate to meet demand once the economy and oil demand recovers. As a result we could find ourselves in another major price upswing.

Let’s set aside the current economic crisis and look further into the future and the role of energy and especially of mobility. At some point, the world economy and demand for energy will recover. And one thing we know for sure is that the world’s population will continue to increase. There will be nearly 9 billion people on the planet by 2030. Most of that growth will be in what are today developing countries. These are all people who will need heat, cooking fuel, and—as they become richer—transportation fuel to satisfy their quest for mobility. Private car ownership rates will go up in line with rising incomes in these countries. China’s car ownership rate, for example today is roughly only where the

United States was during World War I—with about 50 vehicles per 1000 people. The US in contrast today has over 750 cars and light trucks per 1000 people. If China develops anywhere along the path of the US, we could have a step-change in global energy demand in the future.

Meeting this demand over the long term will be a major challenge for the world energy system. Transportation is by far the biggest and fastest growing segment of the oil market. And, globally, petroleum still has a near monopoly on transportation. But over the past decade, rising oil prices and concern about climate change have brought about challengers to petroleum. The most visible challenger has been the biofuels industry, which is chipping away at petroleum's market share.

Given all of the recent petroleum supply constraints—from a lack of access to oil resources to rising costs to a lack of spare refining capacity—biofuels have played an increasingly important role in meeting rising demand. Today ethanol represents almost 8 percent of the US gasoline market by volume. In Brazil, which admittedly has a much smaller energy market than the US, ethanol's share is over 50 percent. In fact, if we were to imagine all the world's biofuel producers as a country, this "biofuel nation" would have been the number three source of liquid fuel supply growth in the past two years. Only Angola and Iraq contributed more to world liquid supply growth in 2007 and 2008.

Despite this impressive recent growth, biofuels still only represent about 3 percent of the world road transportation fuel market in energy terms. A lot more growth will be

necessary to make sustained inroads into the petroleum market. That kind of future growth could still happen, but it's likely to be more difficult. In our view, to scale up further, biofuels will need to pass four key challenges.

The first challenge will be to use land as efficiently as possible. The biofuel industry's footprint matters, because land also has to be used to grow food, animal feed and fiber. In the future the most successful biofuel crops will be those that produce the largest volumes of liquid fuel per unit of land. Part of the answer to this will come from the agricultural community. Seed companies, for example, have a strong record of delivering consistently higher yielding crops. The most optimistic companies believe that corn yields could double by 2030.

The second challenge is economics. Biofuels have generally been more expensive than petroleum. People often ask us, at what oil price is ethanol competitive without subsidies? If we are talking about corn-starch based ethanol, the answer to that question depends on what price corn is selling for, since so much of ethanol's production costs are tied to it. Last year the cost of making ethanol shot up along with crude prices. Even so, ethanol was still cheaper than gasoline for most of the last two years. But the oil market is cyclical, and with the oil price having dropped $100 per barrel, ethanol is once again more expensive than petroleum. Next generation biofuels could be cheaper, but the picture is still uncertain. Cellulosic material like grasses, corn stover and other agricultural residues will be cheaper than corn or sugar, since they have few other uses.

But the capital required to build next generation bio-refineries to process these feedstocks is formidable.

The third key challenge for biofuels is product quality. Let's first recognize that today's biofuels have many positive attributes. Ethanol is a high octane fuel, and both ethanol and biodiesel are very low sulfur fuels, making them a good fit in a world of increasingly strict fuel standards. On the other hand, ethanol has only about 70 percent of the energy content of petroleum gasoline. This means motorists have to fill up more often, or vehicles need to be fitted with larger fuel tanks. For its part, biodiesel doesn't perform well in cold weather. If biofuels are to scale up, they will ultimately need to deliver equal or better reliability and performance than petroleum-based fuels. That's why many in the biofuel industry are already looking past conventional ethanol and biodiesel to the next generation of biofuels that might be engineered to look and behave more like conventional hydrocarbons. If you can design a green hydrocarbon that can be produced out of biomass, this would be a very big deal.

And finally the last challenge is that the biofuels industry will need to grow sustainably as it scales up. This is what most of the controversy is about today. Sustainability means different things to different people. Competition with food is one metric. Clearly there were many reasons unrelated to biofuels why food prices rose last year. But the public perception was that biofuels shared a disproportionate responsibility. A biofuel's carbon footprint is another metric. The secondary effects of growing crops for biofuels are now under examination. Some studies have pointed to the CO_2 emissions caused by land use

changes as more biofuels are produced. The science on this is uncertain and in its early days, but this is unlikely to be an issue that will go away anytime soon. Water use may be another sustainability issue for the ethanol industry. All of this stuff is very complex, and we should recognize that different types of biofuels will stand up differently under various sustainability metrics. But it is clear that sustainability is one area where the industry will face increasing scrutiny going forward.

The potential solution to all these challenges is advanced technology. The industry will need better molecules, better feedstocks and better conversion technologies in order to make the next major leap in scale. Game-changing advances such as the conversion of cellulosic material will be necessary to expand the resource base beyond conventional crops. Advanced technology will also play a key role in improving the sustainability and GHG emissions reduction potential of the biofuels industry.

I'll close by reiterating that the world will likely need an increasingly diversified energy platform for transportation if supply is to keep up with demand in the future. Undoubtedly, the biofuel industry is going through a painful time right now. There's overcapacity and lower oil prices have hurt the industry. But it is likely that the growth we've seen in the biofuel industry is laying the groundwork for that diversified energy platform of the future, especially if the next generation of biofuels evolves and becomes a reality.